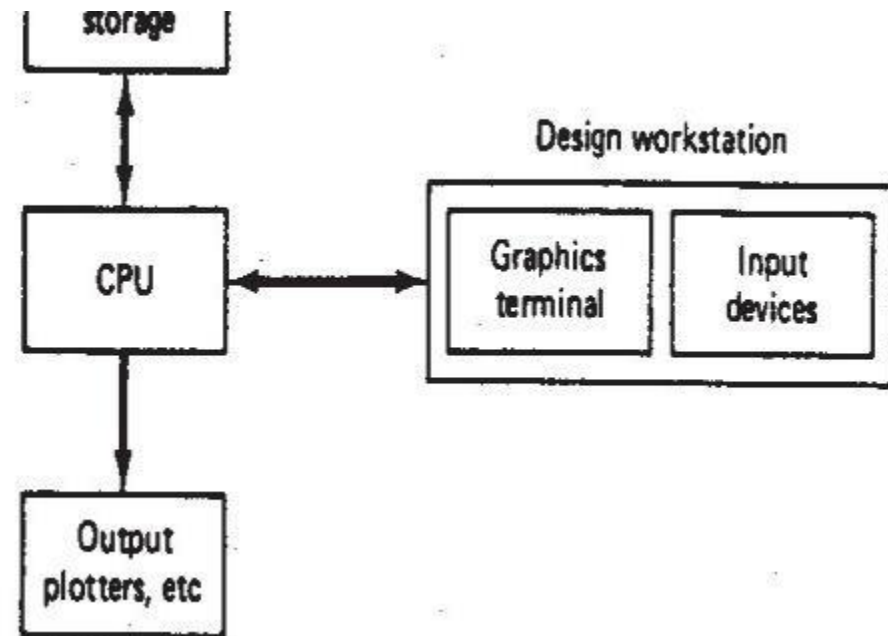


A modern computer-aided design system is based on interactive computer graphics (**ICG**).

With interactive graphics, the system provides an immediate response to inputs by the user. The user and the system are in direct communication with each other, the user entering commands and responding to questions generated by the system.

A stand-alone CAD system would include the following hardware components:

- One or more design workstations. These would consist of:
- A graphics terminal
- Operator input devices
- One or more plotters and other output devices
- Central processing unit (CPU)
- Secondary storage



The workstation must accomplish five functions:

1. It must interface with the central processing unit.
2. It must generate a steady graphic image for the user.
3. It must provide digital descriptions of the graphic image.
4. It must translate computer commands into operating functions.
5. It must facilitate communication between the user and the system.

The use of interactive graphics has been found to be the best approach to accomplish these functions. A typical interactive graphics workstation would consist of the following hardware Components:

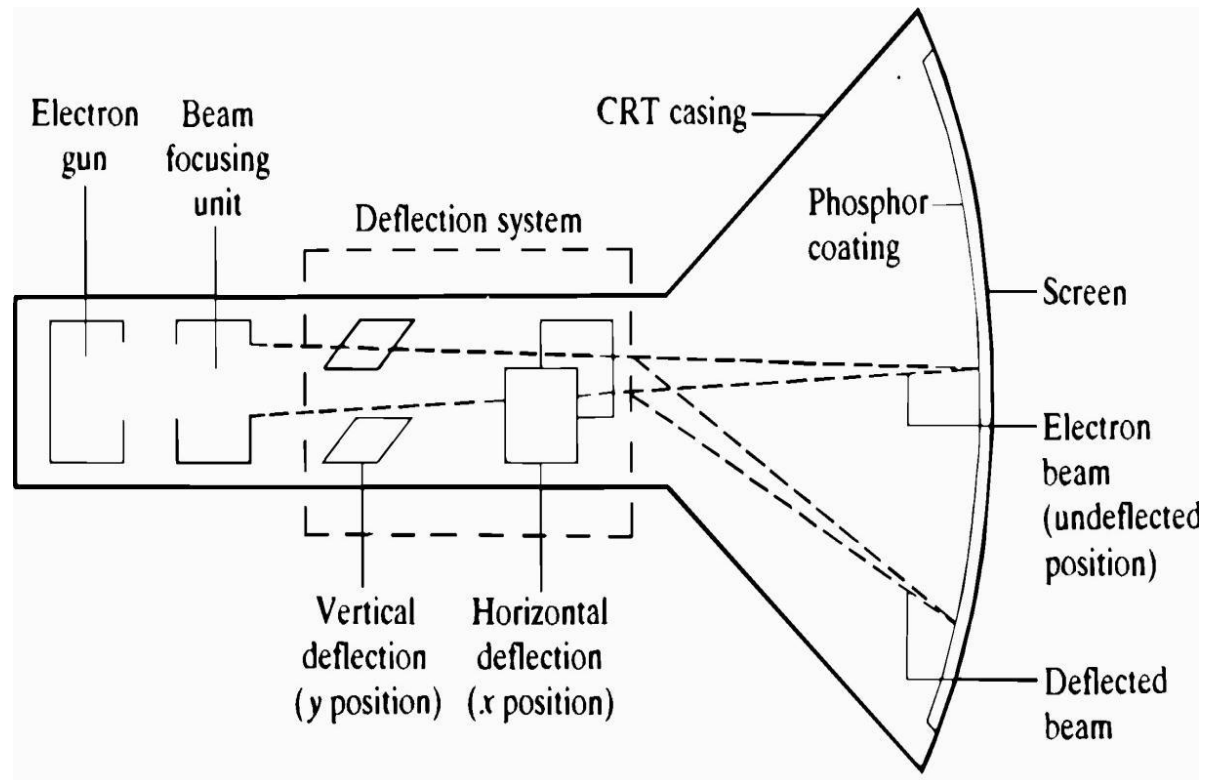
- A graphics terminal- A graphics design workstation showing the components
- Operator input devices

**Image generation in computer graphics-** Nearly all computer graphics terminals available today use the cathode ray tube (CRT) as the display device. Television sets use a form of the same device as the picture tube.

There are two basic techniques used in current computer graphics terminals for generating the image on the CRT screen. They are:

**1. Stroke writing/ line drawing,/ Random position,/ Vector writing, and directed beam:-** The stroke-writing system uses an electron beam which operates like a pencil to create a line image on the CRT screen. The image is constructed out of a sequence of straight-line segments. Each line segment is drawn on the screen by directing the beam to move from one point on the screen to the next, where each point is defined by its x and y coordinates.

**2. Raster scan:-**



**2. Raster scan:-** The viewing screen is divided into a large number of discrete phosphor picture elements, called pixels. The matrix of pixels constitutes the raster. The number of separate pixels in the raster display might typically range from  $256 \times 256$  (a total of over 65,000) to  $1024 \times 1024$  (a total of over 1,000,000 points).

Each pixel on the screen can be made to glow with a different brightness. Color screens provide for the pixels to have different colors as well as brightness. During operation, an electron beam creates the image by sweeping along a horizontal line on the screen from left to right and energizing the pixels in that line during the sweep.

When the sweep of one line is completed, the electron beam moves to the next line below and proceeds in a fixed pattern as indicated in Figure. After sweeping the entire screen the process is repeated at a rate of 30 to 60 entire scans of the screen per second:

The two approaches described above are used in the overwhelming majority of current-day CAD graphics terminals. There are also a variety of other technical factors which result in different types of graphics terminals. These factors include the type of phosphor coating on the screen, whether color is required, the pixel density, and the amount of computer memory available to generate the picture.

We will discuss three types of graphics terminals, which seem to be the most important today in commercially available CAD systems. The three types are:

1. Directed-beam refresh/vector refresh and stroke-writing refresh
2. Direct-view storage tube (DVST)
3. Raster scan (digital TV)